Prelim 1

1 b) $\cancel{\dot{m}_i}^{0} = r_{x,i}\, \ddot{u}_i - (\mu + \theta_{m,i})\, m_i$

solve for m^*

$$\frac{r_{x,i}\, \ddot{u}_i}{(\mu + \theta_{m,i})} = m^* = \left(\frac{r_{x,i}}{\mu + \theta_{m,i}}\right) \ddot{u}_i \qquad u_i = \frac{w_1 + w_2 f_i}{1 + w_1 + w_2 f_i}$$

$K_x(G, \theta)$ $\quad \ddot{u}(I, K)$

$$r_x = k_{E,i}\, R_{x,T} \left(\frac{G_i}{\tau_{x,i}\, K_{x,i} + (\tau_{x,i} + 1)\, G_i} \right)$$

1 a) $\beta = \langle m \rangle\, N\, V$

$\beta = [\,\text{gDW}\,]$

$$\frac{[\text{mmol}]}{[\text{gDW}]} = \langle m \rangle \times N \times \frac{1}{\beta} \times \frac{1\ \text{mol}}{6.02 \times 10^{23}\ \text{mRNA}} \times \frac{10^{3}\ \text{mmol}}{1\ \text{mol}}$$

1 c) $m^* = K_x(G, \theta)\, \ddot{u}(I, K)$

$$K_x(G, \theta) = \frac{r_{x,i}}{\mu + \theta_{m,i}} = \frac{1}{\mu + \theta_{m,i}} \left(k_{E,i}\, R_{x,T} \left(\frac{G_i}{\tau_{x,i}\, K_{x,i} + (\tau_{x,i} + 1)\, G_i} \right) \right)$$

Prelim 1

2.a)

$$\frac{d\bar{X}}{d\bar{t}} = \frac{\bar{a}_x + \bar{\beta}_x S}{1 + S + (\bar{Z}/\bar{Z}_x)^{n_{zx}}} - \bar{\delta}_x \bar{X}$$

$$\frac{d\bar{Z}}{d\bar{t}} = \frac{\bar{\alpha}_z}{1 + (\bar{X}/\bar{X}_z)^{n_{xz}}} - \bar{\delta}_z Z$$

b) $\delta = \frac{\bar{\delta}_z}{\bar{\delta}_x}$ $\quad t = \bar{t}\,\bar{\delta}_x$ $\quad a_x = \frac{\bar{a}_x}{\bar{a}_z}$ $\quad \beta_x = \frac{\bar{\beta}_x}{\bar{\alpha}_z}$

$Z_x = \frac{\bar{Z}\,\bar{\delta}_x}{\bar{\alpha}_z}$ $\quad X_z = \frac{\bar{X}_z \bar{\delta}_x}{\bar{\alpha}_z}$ $\quad X = \frac{\bar{X}\,\bar{\delta}_x}{\bar{\alpha}_z}$ $\quad Z = \frac{\bar{Z}\,\bar{\delta}_x}{\bar{\alpha}_z}$

non D

$$\frac{\bar{\delta}_x \bar{\alpha}_z}{\bar{\delta}_x}\frac{dZ}{dt} = \frac{\bar{\alpha}_z}{1 + (X/X_z)^{n_{xz}}} - \bar{\delta}_z \cancel{\bar{\delta}_x} Z$$

$$\frac{dZ}{dt} = \frac{1}{1 + (X/X_z)^{n_{xz}}} - Z \quad \leftarrow \text{non D} \quad Z$$

$$\frac{dX}{dt} = \frac{\alpha_x + \beta_x S}{1 + S + (Z/Z_x)^{n_{zx}}} - X$$

Error in $t = \bar{t}\,\delta_x$ $\leftarrow$ should be $t = \bar{t}\,\bar{\delta}_x$

c) (see Attachment)

it is reproducible!

d) (see Attachment)

e) For $S=1$

the oscillations lose there coherence

for $S = 1000$

the remain coherent

For $S=1$ the three oscillations are no longer in sync as they continue on. The opposite is seen in $S = 1000$

f) No, the graph is not able to work
the oscillations aren't visible ~~[illegible]~~
they must have used different values